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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/723,509	11/25/2003	Ping-Kun Wu	67,200-1190	8941

7590 05/19/2005

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EXAMINER

CHAMBLISS, ALONZO

ART UNIT	PAPER NUMBER
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2814

DATE MAILED: 05/19/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

EK

Office Action Summary	Application No. 10/723,509	Applicant(s) WU ET AL.	
	Examiner Alonzo Chambliss	Art Unit 2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 April 2005.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-41 is/are pending in the application.
- 4a) Of the above claim(s) 30-41 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-29 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 25 November 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of claims 1-29 in the reply filed on 4/11/05 is acknowledged. The traversal is on the ground(s) that the electroplated copper layer must be planarized prior to any other deposition steps for forming other device feature. This is not found persuasive because the electroplated copper layer can be formed to have recessed (i.e. non planarized surface) so that the next deposition would fill the recess.

Applicant alleges that the plasma treatment step of the first seed layer cannot be substituted by the plasma treatment of the second seed layer. The examiner is stating that the plasma treatment can be substituted by a different treatment other than cited by the applicant.

2. Claims 30-41 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected product claims, there being no allowable generic or linking claim.

The requirement is still deemed proper and is therefore made FINAL.

Drawings

3. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: IMD layer portion 14A. Also, the drawings are objected to as failing to because they include the following reference character(s) not mentioned in the

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description: 203. Corrected drawing sheets in compliance with 37 CFR 1.121(d), or amendment to the specification to add the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Lin et al. (US 6,342,448).

With respect to Claims 1, 10, 11, 18, and 23, Lin teaches providing a substrate comprising a semiconductor substrate 10 and forming an insulator layer (i.e. the combination of 48, 52 which is a low-K dielectric) on the substrate 10. Forming a damascene opening (i.e. the combination of 38, 39) through a thickness portion of the

insulator layer 48, 52. Forming a diffusion barrier layer 62 to line the damascene opening 38, 39 and forming a first seed layer 63 overlying the diffusion barrier 62. Plasma treating the first seed layer 63 in-situ with a first plasma treatment comprising plasma source argon and nitrogen gas. Forming second seed layer 64 or 66 overlying the first seed layer 63 and forming a copper layer 68 overlying the second seed layer 64 or 66 according an electro-chemical plating (ECP) process to fill the damascene opening 38, 39. Plasma treating the second seed layer 64 or 66 with a second treatment plasma comprising an argon and nitrogen gas source. Planarizing the copper layer 68 form a metal interconnect structure (see col. 5 lines 25-67, col. 6 lines 1-10, col. 7 lines 30-54, col. 8 lines 1-67, col. 9 lines 1-39, and col. 10 lines 30-40; Figs. 1A-1D and 3A-3G).

With respect to Claims 2 and 3, Lin teaches wherein the first and second seed layers form a continuous layer over active areas of the substrate (see col. 8 lines 1-67 and col. Figs. 3E and 3F).

With respect to Claims 4 and 5, Lin teaches wherein one of the first an second seed layers is substantially conformally deposited on the top surface of the insulating layer and nonconformally in the damascene opening (see Figs. 3E and 3F).

With respect to Claims 6-9, 19-22, Lin teaches wherein the first and second seed layers is deposited according to a deposition process of IMP or a PVD process (see col. 8 lines 4-67 and col. 9 lines 1-12).

With respect to Claims 12 and 24, Lin teaches wherein the first and second seed layers comprise a material made of TaN and Ta, respectively (see col. 8 lines 4-21).

With respect to Claims 13 and 25, Lin teaches wherein the second seed layer is formed of copper (see col. 9 lines 3-30).

With respect to Claims 14 and 26, Lin teaches wherein the insulator layer comprises a low-K dielectric insulator having a dielectric constant of less than about 3.0 (i.e. 2.6 to 2.8).

With respect to Claims 15 and 27, Lin teaches wherein the first seed layer is formed having a thickness of about 50 Angstroms to about 300 Angstroms (i.e. 230 – 285 Angstroms) (see col. 89 lines 60-62).

With respect to Claims 17 and 29, Lin teaches wherein the diffusion barrier layer comprises a material TaN (see col. 8 lines 38-42).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to

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consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claims 16 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin et al. (US 6,342,448).

With respect to Claims 16 and 28, Lin discloses the second seed layer that has a thickness of 18 to 22 Angstroms (see col. 9 lines 7-10). Lin discloses the claimed invention except for a second seed layer having a thickness of about 100 – 400 Angstroms. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have a second seed layer having a thickness of about 100 – 400 Angstroms, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Allen*, 105 USPQ 233.

The prior art made of record and not relied upon is cited primarily to show the process of the instant invention.

Conclusion

8. Any inquiry concerning the communication or earlier communications from the examiner should be directed to Alonzo Chambliss whose telephone number is (571) 272-1927.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-7956.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system Status information for published applications may be obtained from either Private PMR or Public PMR. Status information for unpublished applications is available through Private PMR only. For more information about the PMR system see <http://pair-dkect.uspto.gov>. Should you have questions on access to the Private PMR system contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free) or EBC_Support@uspto.gov.

AC/April 3, 2005


Alonzo Chambliss
Primary Patent Examiner
Art Unit 2814